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**6N137**
**ICPL2601**

Jameco Part Number 113911

# HIGH CMR, VERY HIGH SPEED OPTICALLY COUPLED ISOLATOR LOGIC GATE OUTPUT

## APPROVALS

- UL recognised, File No. E91231

## DESCRIPTION

The 6N137 / ICPL2601 optocouplers consist of a GaAsP light emitting diode and a high gain integrated photo detector to provide 2500Volts $_{RMS}$ electrical isolation between input and output. An enable input allows the detector to be strobed. The output of the detector I.C. is an open collector Schottky clamped transistor. The ICPL2601 has an internal shield which provides a guaranteed common mode transient immunity specification of 1000V/µs minimum.This unique design provides maximum ac and dc circuit isolation while achieving TTL compatibility. The coupled parameters are guaranteed over the temperature range of 0°C to 70°C, such that a maximum input signal of 5mA will provide a minimum output sink current of 13mA(equivalent to fan-out of eight gates)

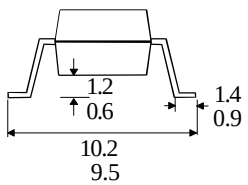
## FEATURES

- High speed - 10MBit/s
- High Common Mode Transient Immunity 10kV/µs typical
- Logic gate output
- ICPL2601 has improved noise shield for superior common mode rejection
- Options :-
  10mm lead spread - add G after part no.
  Surface mount - add SM after part no.
  Tape&reel - add SMT&R after part no.

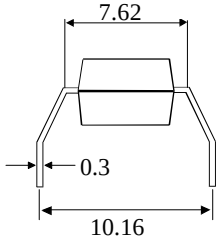
## APPLICATIONS

- Line receiver, data transmission
- Computer-peripheral interface
- Data multiplexing
- Pulse transformer replacement

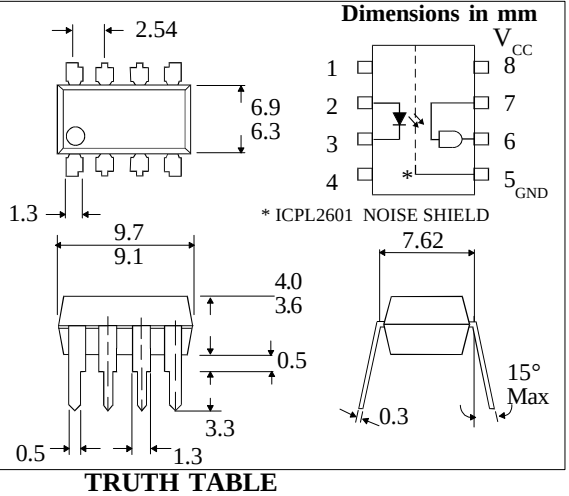
**OPTION SM**
**SURFACE MOUNT**




**OPTION G**




**Dimensions in mm**




## TRUTH TABLE

| INPUT | ENABLE | OUTPUT |
|---|---|---|
| H | H | L |
| L | H | H |
| H | L | H |
| L | L | H |

A 0.1µF bypass capacitor must be connected between pins 8 and 5 ( See note 1)

## ABSOLUTE MAXIMUM RATINGS (25°C unless otherwise specified)

| | |
|---|---|
| Storage Temperature | -55°C to + 125°C |
| Operating Temperature | 0°C to + 70°C |
| Lead Soldering Temperature (1/16 inch (1.6mm) from case for 10 secs) | 260°C |

## INPUT DIODE

| | |
|---|---|
| Average Forward Current | 20mA |
| Reverse Voltage | 5V |

## DETECTOR

| | |
|---|---|
| Enable Input Voltage ( $V_E$ ) (not to exceed $V_{CC}$ by more than 500mV) | 5.5V |
| Reverse Supply Voltage($-V_{CC}$ ) | -500mV |
| Supply Voltage($V_{CC}$ ) (1 minute maximum) | 7V |
| Output Current ( $I_O$ ) | 25mA |
| Output Voltage ( $V_O$ ) | 7V |
| Collector Output Power Dissipation | 40mW |

**ELECTRICAL CHARACTERISTICS ( $T_A$= 0°C to 70°C Unless otherwise noted )**

| PARAMETER | SYM | DEVICE | MIN | TYP* | MAX | UNITS | TEST CONDITION |
|---|---|---|---|---|---|---|---|
| High Level Output Current | $I_{OH}$ | | | 0.02 | 250 | µA | $V_{CC}$ = 5.5V, $V_O$ = 5.5V<br>$I_F$ = 250µA, $V_E$ = 2V |
| Low Level Output Voltage | $V_{OL}$ | | | 0.4 | 0.6 | V | $V_{CC}$ = 5.5V, $I_F$ = 5mA<br>$V_E$ = 2V<br>$I_{OL}$ (sinking ) = 13mA |
| High Level Supply Current | $I_{CCH}$ | | | 10 | 15 | mA | $V_{CC}$ = 5.5V, $I_F$ = 0mA<br>$V_E$ = 0.5V |
| Low Level Supply Current | $I_{CCL}$ | | | 15 | 18 | mA | $V_{CC}$ = 5.5V, $I_F$ = 10mA<br>$V_E$ = 0.5V |
| High Level Enable Current | $I_{EH}$ | | | -1.0 | | mA | $V_{CC}$ = 5.5V, $V_E$ = 2V |
| Low Level Enable Current | $I_{EL}$ | | | -1.5 | -2.0 | mA | $V_{CC}$ = 5.5V, $V_E$ = 0.5V |
| High Level Enable Voltage (note 10) | $V_{EH}$ | | 2 | | | V | $V_{CC}$ = 5.5V, $I_F$ = 10mA |
| Low Level Enable Voltage | $V_{EL}$ | | | | 0.8 | V | $V_{CC}$ = 5.5V, $I_F$ = 10mA |
| Input Forward Voltage | $V_F$ | | | 1.55 | 1.75 | V | $I_F$ = 10mA, $T_A$ = 25°C |
| Input Reverse Breakdown Voltage | $V_{BR}$ | | 5 | | | V | $I_R$ = 10µA, $T_A$ = 25°C |
| Input Capacitance | $C_{IN}$ | | | 60 | | pF | $V_F$ = 0, f = 1MHz |
| Temperature Coefficient of Forward Voltage | $\frac{\Delta V_F}{\Delta T_A}$ | | | -1.4 | | mV/°C | $I_F$ = 10mA |
| Input-output Isolation Voltage (note 3) | $V_{ISO}$ | | 2500 | 5000 | | $V_{RMS}$ | R.H.equal to or less than 50%, t = 1min, $T_A$= 25°C |
| Input-output Insulation Leakage Current (note 3) | $I_{I-O}$ | | | | 1 | µA | R.H. = 45%<br>t = 5s, $T_A$= 25°C<br>$V_{I-O}$ = 3000V dc |
| Resistance (Input to Output) (note 3) | $R_{I-O}$ | | | $10^{12}$ | | Ω | $V_{I-O}$ = 500V dc |
| Capacitance (Input to Output) (note 3) | $C_{I-O}$ | | | 0.6 | | pF | f = 1MHz |

* All typicals at $T_A$= 25°C

**RECOMMMENDED OPERATING CONDITIONS**

| PARAMETER | SYMBOL | MIN | MAX | UNITS |
|---|---|---|---|---|
| Input Current, Low Level | $I_{FL}$ | 0 | 250 | µA |
| Input Current, High Level | $I_{FH}$ | 6.3* | 15 | mA |
| Supply Voltage, Output | $V_{CC}$ | 4.5 | 5.5 | V |
| Enable Voltage, Low Level | $V_{EL}$ | 0 | 0.8 | V |
| Enable Voltage, High Level | $V_{EH}$ | 2.0 | $V_{CC}$ | V |
| Fan Out ( TTL Load ) | N | | 8 | |
| Operating Temperature | $T_A$ | 0 | 70 | °C |

*6.3mA is a guard banded value which allows for at least 20% CTR degradation.
Initial input current threshold value is 5.0mA or less

**SWITCHING SPECIFICATIONS AT $T_A$ = 25°C ( $V_{CC}$ = 5V, $I_F$ = 7.5mA Unless otherwise noted )**

| PARAMETER | SYM | DEVICE | MIN | TYP | MAX | UNITS | TEST CONDITION |
|---|---|---|---|---|---|---|---|
| Propagation Delay Time to Logic Low at Output ( fig 1 )( note4 ) | $t_{PHL}$ | | | 55 | 75 | ns | $R_L$ = 350Ω, $C_L$ = 15pF |
| Propagation Delay Time to Logic High at Output ( fig 1 )( note5 ) | $t_{PLH}$ | | | 45 | 75 | ns | $R_L$ = 350Ω, $C_L$ = 15pF |
| Propagation Delay Time of Enable from $V_{EH}$ to $V_{EL}$ ( note6 ) | $t_{EHL}$ | | | 14 | | ns | $R_L$ = 350Ω, $C_L$ = 15pF<br>$V_{EL}$ = 0V, $V_{EH}$ = 3V |
| Propagation Delay Time of Enable from $V_{EL}$ to $V_{EH}$ ( note7 ) | $t_{ELH}$ | | | 25 | | ns | $R_L$ = 350Ω, $C_L$ = 15pF<br>$V_{EL}$ = 0V, $V_{EH}$ = 3V |
| Common Mode Transient Immunity at Logic High Level Output ( fig 2 )( note8 ) | $CM_H$ | 6N137<br>ICPL2601 | <br>1000 | 10000<br>10000 | | V/µs<br>V/µs | $I_F$ = 0mA, $V_{CM}$ = 50$V_{PP}$<br>$R_L$= 350Ω,$V_{OH}$= 2Vmin. |
| Common Mode Transient Immunity at Logic Low Level Output ( fig 2 )( note9 ) | $CM_L$ | 6N137<br>ICPL2601 | <br>-1000 | -10000<br>-10000 | | V/µs<br>V/µs | $V_{CM}$= 50$V_{PP}$<br>$R_L$=350Ω,$V_{OL}$=0.8Vmax. |

NOTES:-

1 Bypassing of the power supply line is required, with a 0.01µF ceramic disc capacitor adjacent to each isolator. The power supply bus for the isolator(s) should be seperate from the bus for any active loads. Otherwise a larger value of bypass capacitor (up to 0.1µF) may be needed to supress regenerative feedback via the power supply.

2 Peaking circuits may produce transient input currents up to 50mA, 50ns maximum pulse width, provided average current does not exceed 20mA.

3 Device considered a two terminal device; pins 1, 2, 3, and 4 shorted together, and pins 5, 6, 7 and 8 shorted together.

4 The $t_{PHL}$ propagation delay is measured from the 3.75 mA level Low to High transition of the input current pulse to the 1.5V level on the High to Low transition of the output voltage pulse.

5 The $t_{PLH}$ propagation delay is measured from the 3.75mA level High to Low transition of the input current pulse to the 1.5V level on the Low to High transition of the output voltage pulse.

6 The $t_{EHL}$ enable input propagation delay is measured from the 1.5V level on the Low to High transition of the enable input voltage pulse to the 1.5V level on the High to Low of the output voltage pulse.

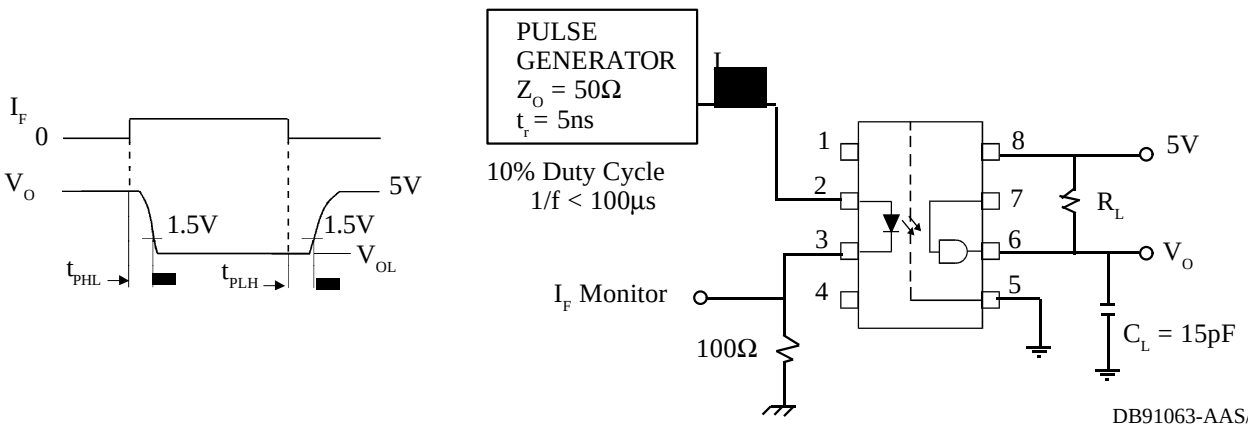
7 The $t_{ELH}$ enable input propagation delay is measured from the 1.5V level on the High to Low transition of the enable input voltage pulse to the 1.5V level on the Low to High of the output voltage pulse.

8 $CM_H$ is the maximum tolerable rate of rise of the common mode voltage to assure that the output will remain in a high logic state (ie Vout > 2.0V).

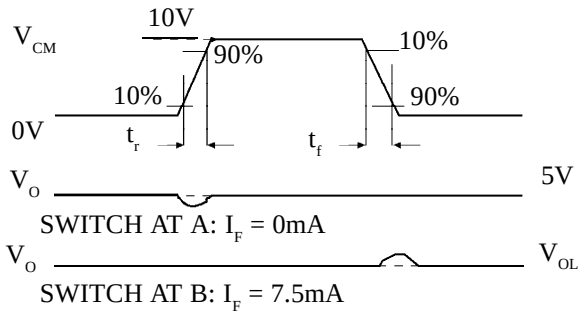
9 $CM_L$ is the maximum tolerable rate of fall of the common mode voltage to assure that the output will remain in a low logic state (ie Vout < 0.8V)

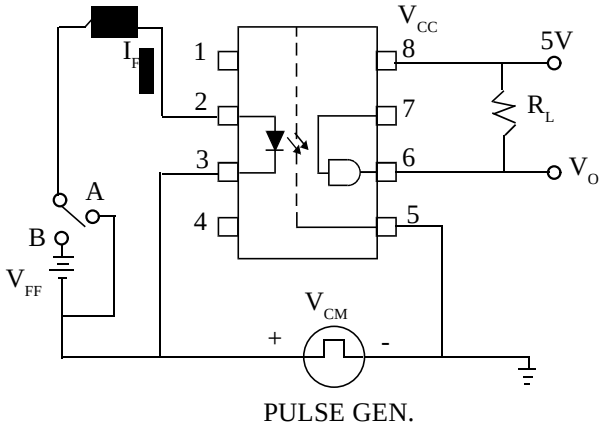
10 No external pull up is required for a high logic state on the enable input.

**FIG.1 SWITCHING TEST CIRCUIT**

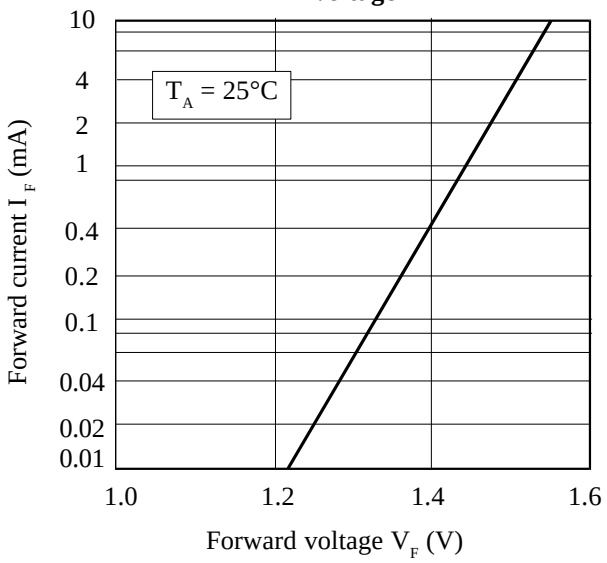


## FIG. 2 TEST CIRCUIT FOR TRANSIENT IMMUNITY AND TYPICAL WAVEFORMS

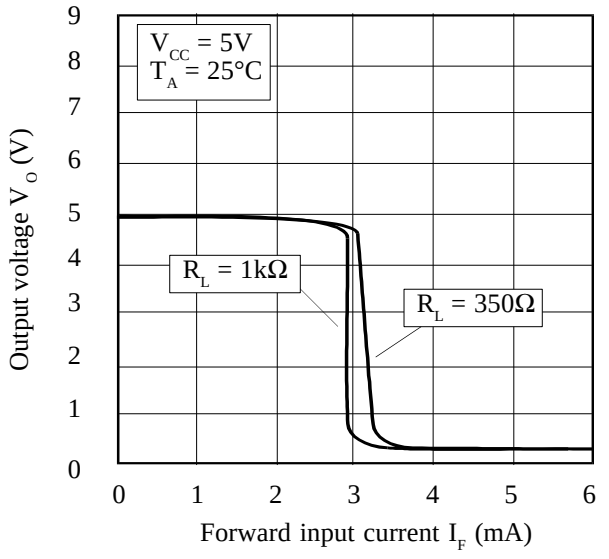


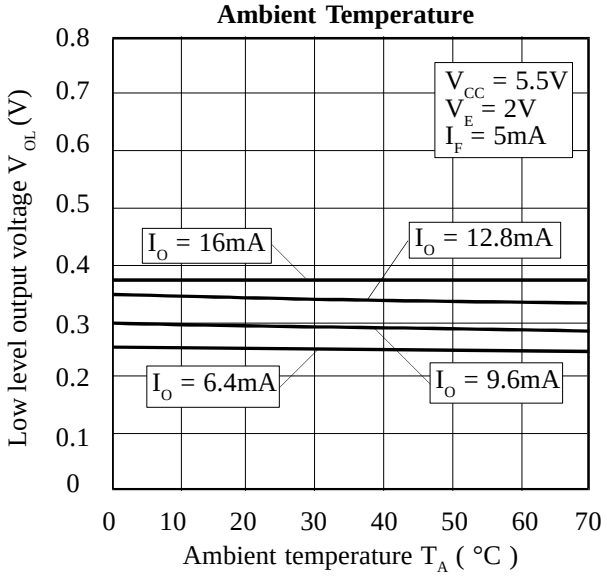

**Forward Current vs. Forward Voltage**




**Output Voltage vs. Forward Input Current**




**Low Level Output Voltage vs. Ambient Temperature**




**High Level Output Current vs. Ambient Temperature**